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ABSTRACT

This paper describes an electronic classroom (ECR) program that has been developed at Nova University to facilitate online real-time group instruction in graduate degree programs in information and computer science. The first section describes the educational uses of the program, including the simulation of a classroom-type educational setting with question handling, response tallying, and the automatic sequencing of lesson frames. The design problems associated with use of the program are described in the second section, and the third outlines alternate uses for the ECR program, including evaluation of instruction and programs, Delphi techniques for curriculum and program planning, and several group participation methodologies such as the online charrette, brainwriting, nominal group technique, cross impact analysis, and the futurewheel. In conclusion, it is noted that one of the major challenges for faculty is to determine what mix should be provided of online lectures, face-to-face seminars, and written assignments. (4 references) (GL)

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An On-line Classroom for the Unix Environment

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Abstract

A "C" program has been developed that facilitates online real-time group instruction in graduate degree programs in information and computer science using BSD 4.2 Unix*. This paper describes the educational uses, including the simulation of a classroom-type educational setting with question handling, response tallying, and the automatic sequencing of lesson frames.

INTRODUCTION:

Shortly after reading lecture notes, printed on the chalkboard, a student has a question regarding one of the notes. Many of the 24 students in the class are happy to see this, since they had the same question. The teacher answers the question, to the satisfaction of all, and then continues with the lecture. After a few more chalkboards of notes, the teacher decides to give a pop quiz. The question is put on the chalkboard and the students are asked to answer. The teacher finds that several of the students do not know the answer. She reviews the related material until all understand.

This may sound like an ordinary classroom, but it's not. These students are in their own homes, and are attending a lecture class hosted online in Unix. They reside all over the United States and have logged into the University's computer system, using their personal computer, and are running the Electronic Classroom. This paper tells how this all came about.

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* Unix is a trademark of AT&T and Bell Laboratories

Over the past five years, there has been a rapid increase in the use of telecommunications and the computer in delivering instruction. Many of these examples are based in electronic mail and bulletin boards as the medium of instruction (Hiltz and Turoff, 1985). Some recent models of computer-based instruction have involved other utilities that have opened a broad range of alternatives for learning in engineering and the sciences. The trend is to provide more computing capability online that includes a wide range of applications programs and tools in addition to the standard communication mechanisms.

Carnegie-Mellon University announced its entry into electronic learning environments with the system they call Andrew, named after the founders of the institution (Morris, et. al., 1986). C-MU leaders expect Andrew to have a major positive impact on the institution by supporting: computer-aided instruction, the methods used in professional work, communication among students and faculty, and information access and delivery. The system uses personal computers, raster graphics, local-area networks, and the Unix operating system as the base for the environment.

The Athena system at MIT has many of the same features of the C-MU system. The project focuses on the development of a complete learning environment with a heavy emphasis on computer-based learning concepts (Balkovich, Lerman, and Parmalee, 1986). These include using the computer to sup-

port learning through simulation and gaming, as a virtual laboratory for experimentation, as a tutor, in the presentation of graphical information, and finally, as a communication medium. Unix is seen in the Athena system as a foundation for all applications that exist both at the network and the workstation level.

The computer-based programs at Nova University began in the Fall of 1983, and depend heavily on microcomputers, modems, and telecommunication networks in conjunction with a supermini computer host (Scigliano and Centini, 1985). Students from 26 different states, including Alaska, conduct their online classwork in coordination with lecturers that teach the seminars. Students complete their online work using the tools of Unix, and they do work offline using a portable computer with its word processor and other utilities.

In all these computer-based programs, students work extensively at home and with word processors preparing assignments and projects for transmission online. They also contact their professors online and participate in electronic conferences. There are a number of electronic tools online in the Unix system that all students must master as well.

RATIONALE AND ASSUMPTIONS:

One of the constraints or limitations of online work versus regular classroom teaching and learning is that students have not been able to feel that they are members of a group participating in discussions and getting immediate feedback to their questions and comments. Utilities that have been used in supporting telecommunications-based courses online have been of a nature that the student had to defer gratification by waiting for a response from the teacher or a peer, perhaps for as long as a week or so. These programs have included electronic mail, bulletin boards, and computer conferencing systems that all require the student to wait for an answer. Individual one-on-one communications has been possible for sometime with software packages in Unix like "talk" and "phone" but these have some additional limitations that work for very small groups. The Electronic Classroom "ECR" developed at Nova University attempts to overcome these problems.

The Electronic Classroom is based on the assumption that a lot of good things happen in a classroom that cannot be replicated by electronic mail and computer conferencing or even one-on-one communication; things like the student seeing opposing views on issues, listening in on challenging statements that are made by classmates (or by the teacher), and a general feeling of belonging to a com-

munity that has a meaning all its own (sense of identity, feeling of belonging to a group, and a general appreciation that one is not learning in total isolation). Until ECR was developed, there were no effective utilities that could enable a student to participate in a group online discussion, or to watch a lecture or demonstration in progress as a member of a group of students.

ECR overcomes most of these constraints and barriers by making it possible for medium sized groups of students to attend lectures, ask questions and get answers in real-time, and participate as a member of a learning group in much the same way he or she would in the traditional classroom. ECR accomplishes this by satisfying a set of metaphors and assumptions about teaching and learning in the classroom. These assumptions are:

There are significant benefits to classroom type learning in the traditional "four-wall" sense.

> Classroom learning in ECR without touch or visual recognition of classmates facial features is an acceptable substitute. for the traditional, "four-wall" room.

The metaphors focus on what the teacher and the student do in a typical classroom situation, for example: teacher writes on chalkboard; student raises hand; student asks questions; teacher answers questions; student takes notes; teacher keeps records; and student leaves the class at the end. All of these actions have been satisfied in the ECR design.

OVERVIEW OF THE ECR PROGRAM:

The ECR program emulates a traditional classroom setting, chalkboard and all. With the use of curses(3x) windows, ECR displays a chalkboard and question window, providing the teacher with a communication medium, where a traditional classroom lecture may be conducted with online students. The teacher types material on the chalkboard for all students to see. Students may ask questions by using the question window. The question window, when not in use by a student, becomes a display window for classroom status.

When the ECR program is first invoked, it displays the chalkboard (Top window), the question space (Bottom window), a list of students currently in class (Attendance

list), and the teacher's name on the top of the chalkboard. As students arrive, the display window is changed to update the current student attendance list. After the last student has joined the class, the teacher will start the class.

To conduct a lecture, the teacher types material on the chalkboard for all students to see. During the lecture, if a student has a question, the student may issue a command <ESC>A to inform the teacher (similar to "raising a hand"). When the teacher reaches a comfortable breaking point in the lecture, he or she may allow the students question to proceed. While a student is asking a question, his or her typed text is displayed on the question window for all students to see. The display window then becomes a question window.

Many additional commands are at the teacher's finger tips to ease the job of delivering a lecture. Because students read at different speeds, ECR provides the teacher with a mechanism for determining when all students have finished reading the text currently displayed on the chalkboard. All students are prompted to respond when they have finished reading, so the teacher can continue after the last student finishes. This feature is useful for the teacher when using the magic drawing board and/or "run course" feature.

At any point during a lecture, the teacher may ask a question for all students to answer. ECR will

automatically prompt for responses, and display the collected results on the display window. The teacher may ask TRUE/FALSE or multiple choice questions. In addition, the teacher may dump the question and collected responses to a Unix file for later use. (This feature can be used to give a pop quiz or complete exam.)

All commands must be proceeded by the <ESC> (Escape) key. An "*" (asterisk) will be displayed on the line above the display/question window to remind the student that he or she has entered "command mode." If a command has not been selected within 10 seconds, ECR will exit the command mode automatically.

DESIGN ASPECTS:

The design problems that had to be solved grew from the goal that was set for ECR--to emulate a classroom setting online. In a real classroom, the teacher usually uses a chalkboard and/or overhead projector to introduce lecture material to the students. The students may ask questions during the lecture. There is a one-to-many relationship between teacher and students with a well known protocol available for the exchange of information. To simulate a real classroom, it is necessary to duplicate most of these protocol features.

The teacher's chalkboard is represented by a window at the top of the screen. The teacher uses this "chalkboard

window" to introduce material to the students. The curses(3x) windowing package, available on most versions of Unix, was used to create and maintain this window, and all other parts of the screen.

The text that appears on the chalkboard, either typed by the teacher or displayed automatically by ECR, is delivered to each student via sockets, an interprocess communications facility available on Unix BSD type systems. These facilities provide the necessary communications network needed to connect and communicate with each student in the class.

ALTERNATE USES AND EVALUATION:

ECR has been helpful in academic situations other than the classroom emulation. These include evaluation of instruction and programs, Delphi techniques for curriculum and program planning, and several group participation methodologies such as the online charrette, brainwriting, nominal group technique, cross impact analysis, and the futurewheel. ECR has been used for program review and needs surveys. Students are asked regularly to rate instruction as well as to give feedback about future uses of the utility. One survey resulted in the students stating that they would like to see more lectures presented on computer concepts that were not presented in the regular curriculum. ECR has a Delphi mode, where students can provide feedback on survey items and at the same time view the responses of their colleagues.

The Electronic Classroom has proven its effectiveness in delivering a classroom type of instruction to students that are located in different areas of the country. Through use of the Unix operating system, the ECR provides an online environment where up to 24 students can participate in lectures, demonstrations, and other group processes for evaluation and planning of instruction. Preliminary results of evaluations indicate that student response to ECR is positive. Their comments lend support to the assumptions upon which the system is based: that real-time group interaction provides an essential dimension to learning.

Student comments have included many positive statements that portray their support for the concept. Some of the comments are included below:

> I looked forward to the Electronic Classroom and couldn't help tell all my colleagues about it during this past week. Now that I have had the experience, I am even more enthusiastic.
>
> I think the whole concept is a good one. As has been pointed out, the one major problem with this kind of instruction is the absence of human exchange. The ECR concept is probably the closest we can come electronically to that interaction.
>
> I want to let you know that I think ECR is GREAT!! It's really like sitting in a classroom. My wife and

children looked over my shoulder for a few minutes last Sunday and couldn't believe what we were doing. Like I've said before; you're using the technology to teach the technology.

CONCLUSION:

One of the challenges faced by faculty is to determine what mix should be provided of online lectures, face-to-face seminars, and written assignments. Time spent in an online lecture appears to pay dividends in terms of student learning and positive attitudes, but has a cost associated with it. Academic programs that use online services are billed approximately $7.00 per connect hour. This includes both Tymnet charges and connect time on the VAX-11/780. The decision to use ECR as an aid to instruction is one that must be made with the total education of the student in mind. Current feelings by faculty and administrators alike is that the ECR utility is well worth the expense, and more use will be made of it in current programs as well as in designing new ones in the future.

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